

## **Effectiveness of conservation agriculture practices on soil erosion processes in semi-arid areas of Zimbabwe**

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The application of fallout radionuclides (FRNs) in soil erosion and redistribution studies has gained popularity since the late 1980s. In Zimbabwe, soil erosion research was mostly based on conventional methods which included the use of erosion plots for quantitative measurements and erosion models for predicting soil losses. Only limited investigation to explore the possibility of using Caesium-137 (Cs-137) has been reported in the early 1990s for undisturbed and cultivated lands in Zimbabwe.

In this study, the Cs-137 technique was applied to assess the impact of soil conservation practices on soil losses and to develop strategies and support effective policies that help farmers in Zimbabwe for sustainable land management.

The study was carried out at the Makoholi research station 30 km north of the Masvingo region which is located 260 km south of Harare. The area is semi-arid and the study site comprises coarse loamy sands, gleyic lxisols. The conservation agriculture (CA) practices used within the area since 1988 include (i) direct seeding (DS) with mulch, (ii) CA basins with mulch, and (iii) 18 years direct seeding, left fallow for seven years and turned into conventional tillage since 2012 (DS/F/C).

The Cs-137 reference inventory was established at  $214 \pm 16$  Bq/m<sup>2</sup>. The mean inventories for DS, CA basins and DS/F/C were 195, 190 and 214 Bq/m<sup>2</sup> respectively. Using the conversion Mass Balance Model 2 on the Cs-137 data obtained along transects for each of the practices, gross erosion rates were found to be 7.5, 7.3 and 2.6 t/ha/yr for direct seeding, CA basins and the DS/F/C while the net erosion rates were found to be 3.8, 4.6 and 0 t/ha/yr respectively. Sediment delivery ratios were 50%, 63% and 2% in the respective order.

These preliminary results showed the effectiveness of DS over CA basins in erosion control. The efficiency of fallowing in controlling excessive soil loss was significant in the plot that started as DS for 18 years but left fallow for 7 years before being conventionally tilled.

Despite lower fallout in the southern hemisphere than in the northern hemisphere, this study demonstrates the potential of the Cs-137 technique in assessing field-scale variations of soil loss and redistribution arising from different agricultural management practices in semi-arid areas of Zimbabwe.